

## Lecture Module - Electrical Instruments

ME3023 - Measurements in Mechanical Systems

Mechanical Engineering

Tennessee Technological University

### Topic 1 - Electrical Instruments

## Module 1 - Electrical Instruments

- Topic 1 - Performing Analog Measurements
- Topic 2 - Building Prototype Circuits
- Topic 3 - Time Varying Signals
- Topic 4 - Oscilloscope Troubleshooting

## Topic 1 - Performing Analog Measurements

- Safety and Electricity
- Using a Digital Multimeter
- Measuring Voltage and Current
- Measuring Resistance and Continuity

# Safety and Electricity

Complete the safety training modules to learn more.

# Using a Digital Multimeter

## Benchtop Multimeter

- DMM
- Interface varies by manufacturer
- Features vary by model



Image: Bk Precision Multimeter

# Using a Digital Multimeter

## Handheld Multimeter



Image: [Digital Multimeter - Wikimedia Commons](#)



Image: [Fluke 115 - Wikimedia Commons](#)



Image: [Clampmeter 337 - Wikimedia Commons](#)

# Measuring Voltage and Current

## Voltage



Image: Bk Precision Multimeter

[Read about measuring DC voltage](#)  
[or AC voltage](#)

# Measuring Voltage and Current

## Current



Image: Bk Precision Multimeter

[Read about measuring current \(with clamp\)](#)

# Measuring Resistance and Continuity

## Resistance



Image: Bk Precision Multimeter

[Read about measuring resistance](#)

# Measuring Resistance and Continuity

## Continuity



Image: Bk Precision Multimeter

[Read about measuring continuity](#)

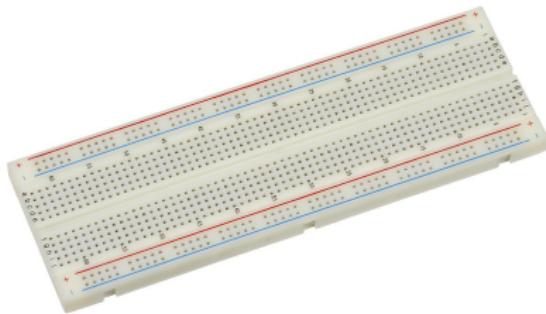
## Topic 2 - Building Prototype Circuits

- Circuits for Mechanical Engineers
- Using a Solderless Breadboard
- Using a Desktop Power Supply
- Examples

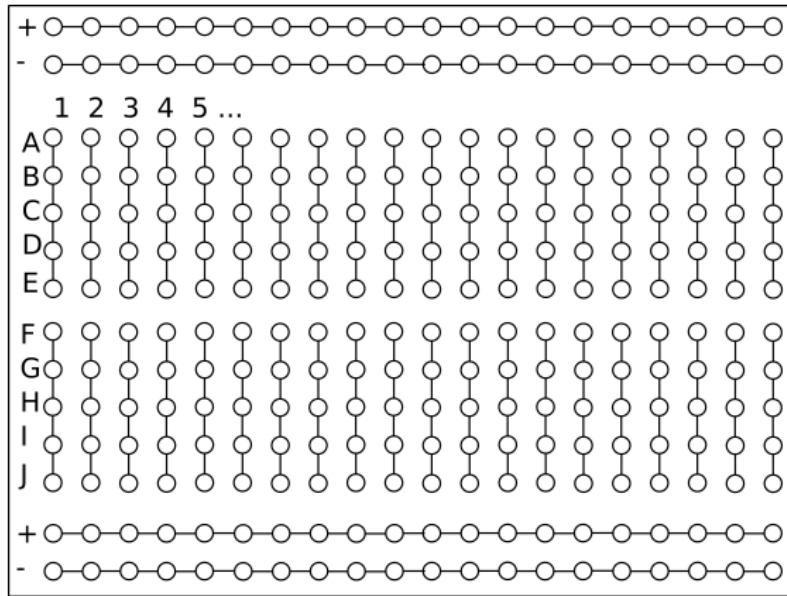
# Circuits for Mechanical Engineers

Engineering is an integrated field...

# Using a Solderless Breadboard



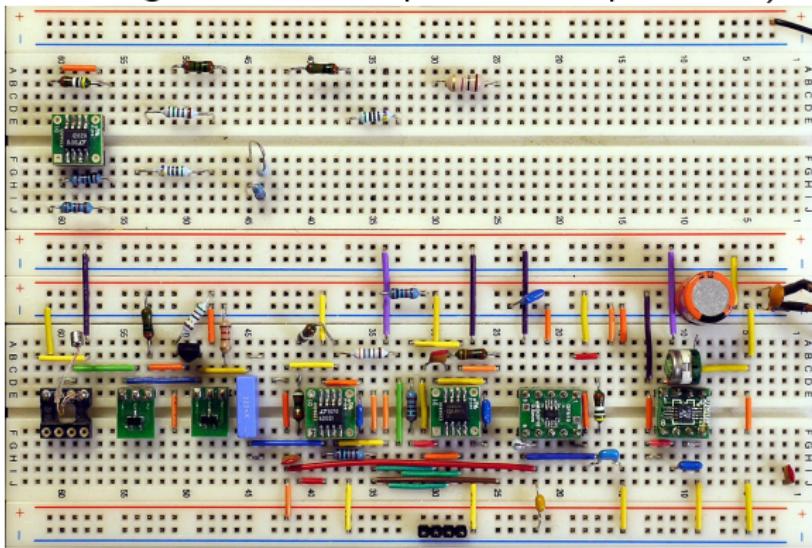
# Using a Solderless Breadboard



# Using a Solderless Breadboard

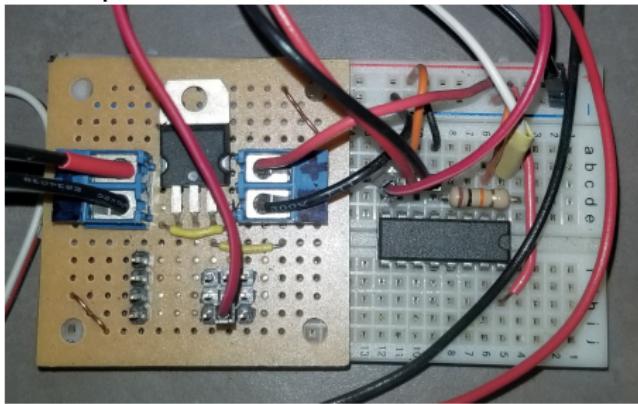
## Example 1:

Question: Why is the breadboard separated into sections? (note: this image shows 4 - top, bottom,top,bottom)



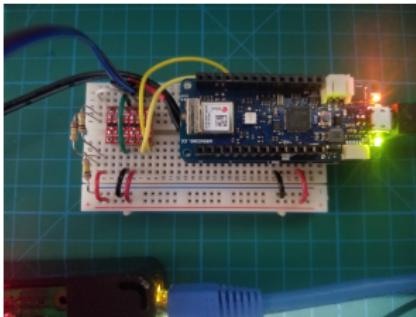
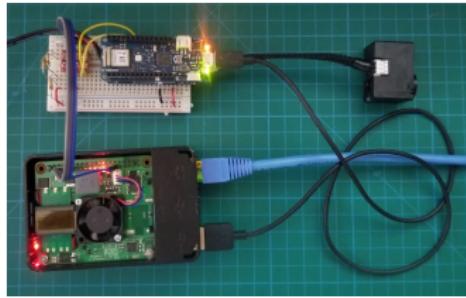
# Using a Solderless Breadboard

Example 2:



# Using a Solderless Breadboard

Example 3:



# Using a Solderless Breadboard

Pros:

Cons:

Common Mistakes:

# Using a Desktop Power Supply



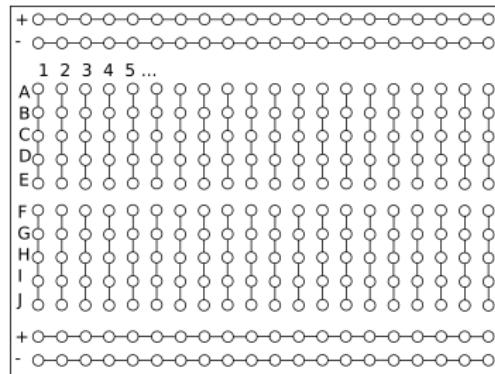
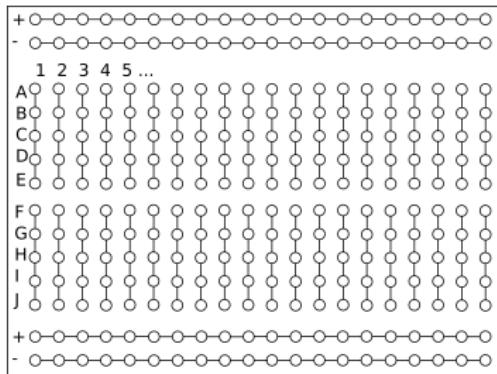
# Using a Desktop Power Supply



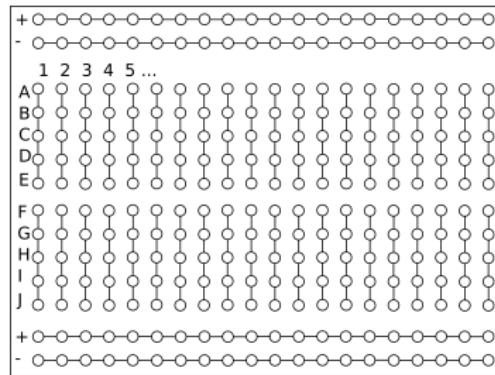
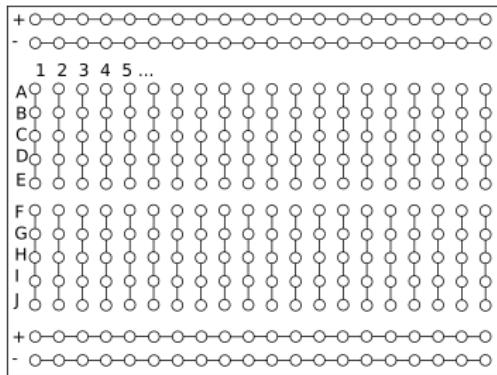
# Using a Desktop Power Supply

- - Equipment Safety
- - Damage
- - Protection

# Examples



# Examples



## Topic 3 - Time Varying Signals

- Using a Function Generator
- Using an Oscilloscope
- Pros, Cons, and Pitfalls
- Activity

Performing Analog Measurements  
Building Prototype Circuits  
Time Varying Signals

Using a Function Generator  
Using an Oscilloscope  
Using an Oscilloscope  
Activity

# Using a Function Generator

# Using an Oscilloscope

Text: Theory and Design of Mech. Meas.

# Pros, Cons, and Pitfalls

Text: Theory and Design of Mech. Meas.

Performing Analog Measurements  
Building Prototype Circuits  
Time Varying Signals

Using a Function Generator  
Using an Oscilloscope  
Using an Oscilloscope  
Activity

# Activity